ORNAMENTAL PLANTS

RESEARCH LABORATORY

AGRICULTURAL RESEARCH SERVICE

WESTERN REGION

UNITED STATES DEPARTMENT OF AGRICULTURE

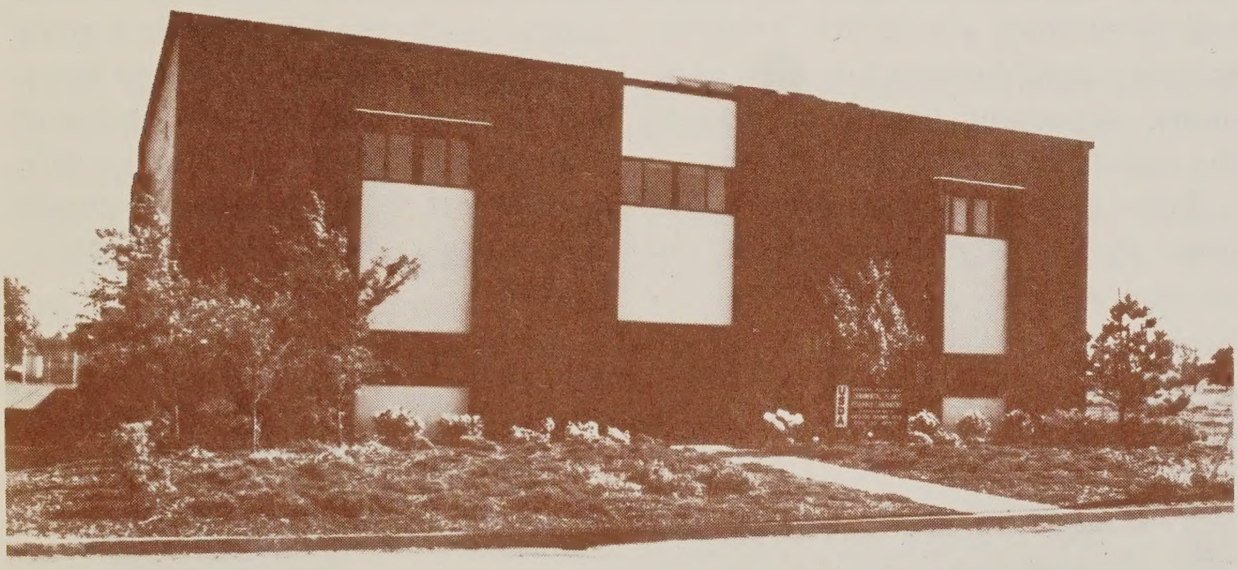
ORNAMENTAL PLANTS RESEARCH LABORATORY

HISTORICAL DEVELOPMENT

The Ornamental Plants Research Laboratory, Corvallis, Oregon, a unit of the Agricultural Research Service, U.S. Department of Agriculture, was established in 1973 to provide a facility for studies and scientific research on the breeding and culture of ornamental plants. The research was needed to support the nursery and florist crop industries.

These industries rapidly expanded in the mid-sixties, an expansion which has continued. According to recent estimates, the wholesale value of nursery and florist crops, on a national basis, has doubled every 7 years since 1956. The current annual farm value of nursery stock alone in the United States is estimated at about $1 billion.

Research at the Laboratory and at its satellite work station at Puyallup, Washington, is conducted in close cooperation with scientists of both the Oregon and Washington State Universities, the Forest Service, and with the Environmental Protection Agency.



The Ornamental Plants Research Laboratory on the Oregon State University Campus in Corvallis, OR.

The primary mission of the researchers at the ARS facilities is to conduct studies leading to improved quantity, quality, and variety of florist and nursery plants produced in

the Pacific Northwest for use worldwide.

Findings by the laboratory researchers already benefiting the industry or leading to additional research that will one day benefit the industry include: a technique for controlling *Phytophthora* blight in cut holly, the use of beneficial fungi to increase vegetative propagation of woody landscape plants, and the discovery of the first known virus disease in rhododendron.

THE MISSION

The nursery and florist crops under study by the ARS scientists are plants intended to enhance man's environment. These crops are considered horticultural specialty crops and sometimes are called "environmental plants" because they serve in so many important ways to improve the quality of man's surroundings.

These plants not only play major roles in beautifying the world we live in, they also perform unique and indispensible functions. Trees, shrubs, flowers, and grasses help reduce noise, help control erosion, act as windbreaks, are useful in road safety, purify the air, provide a green oasis in the paved deserts of our cities, and are key elements contributing to our general piece of mind. Obviously, every effort should be made to ensure continuing production and main-

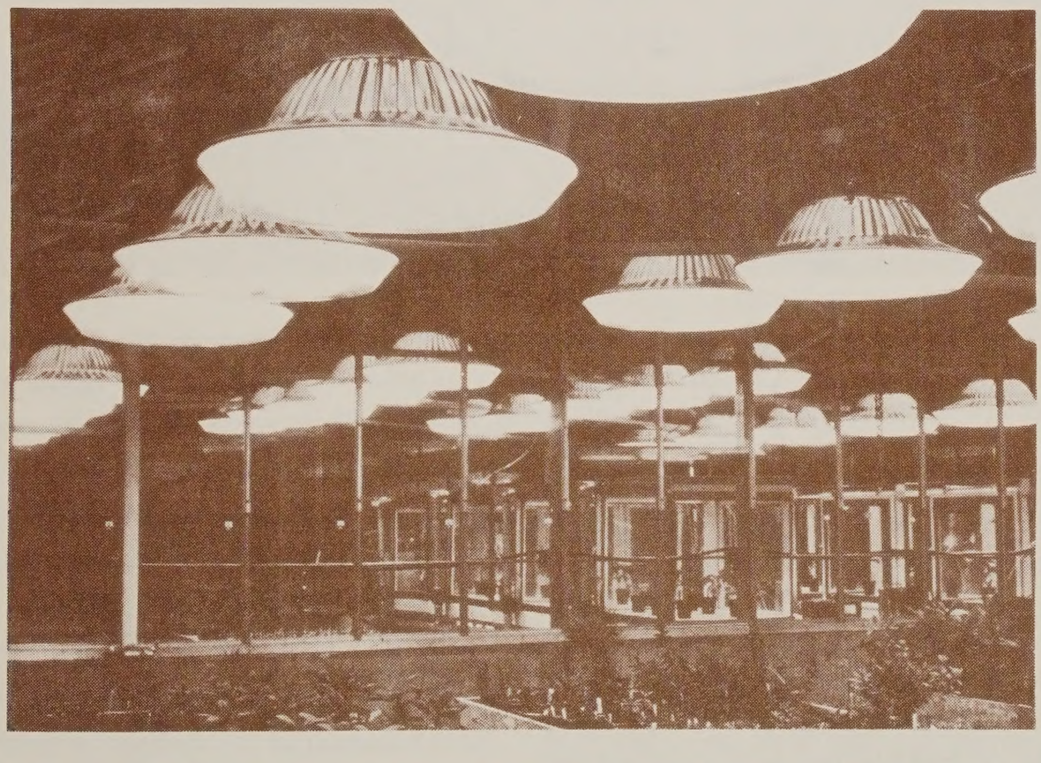
Washington State's Puyallup Valley, a major flowering bulb-producing area where some 50 million tulips, daffodils, and iris are grown annually for both domestic and international markets.

tenance of these vital plants. And while helping to ensure "green survival" is everyone's job, it is the research by plants scientists that is especially necessary. It is they who are charged with finding ways to help plants ward off diseases, to cope with the plants' pest and weed problems, to find improved growing techniques for better quality plant materials, and to develop the new and improved plant types to fill man's ever-changing needs.

The studies of ARS research staff of the Corvallis and Puyallup units are primarily oriented toward the problems and needs of the nursery, bulb, and florist industries in the Pacific Northwest. However, because the commodities of these industries are largely exported to other States, the research findings and results here have significant impact not only on the agriculture and economy of the Northwest States but on the rest of the Nation as well.

FACILITIES

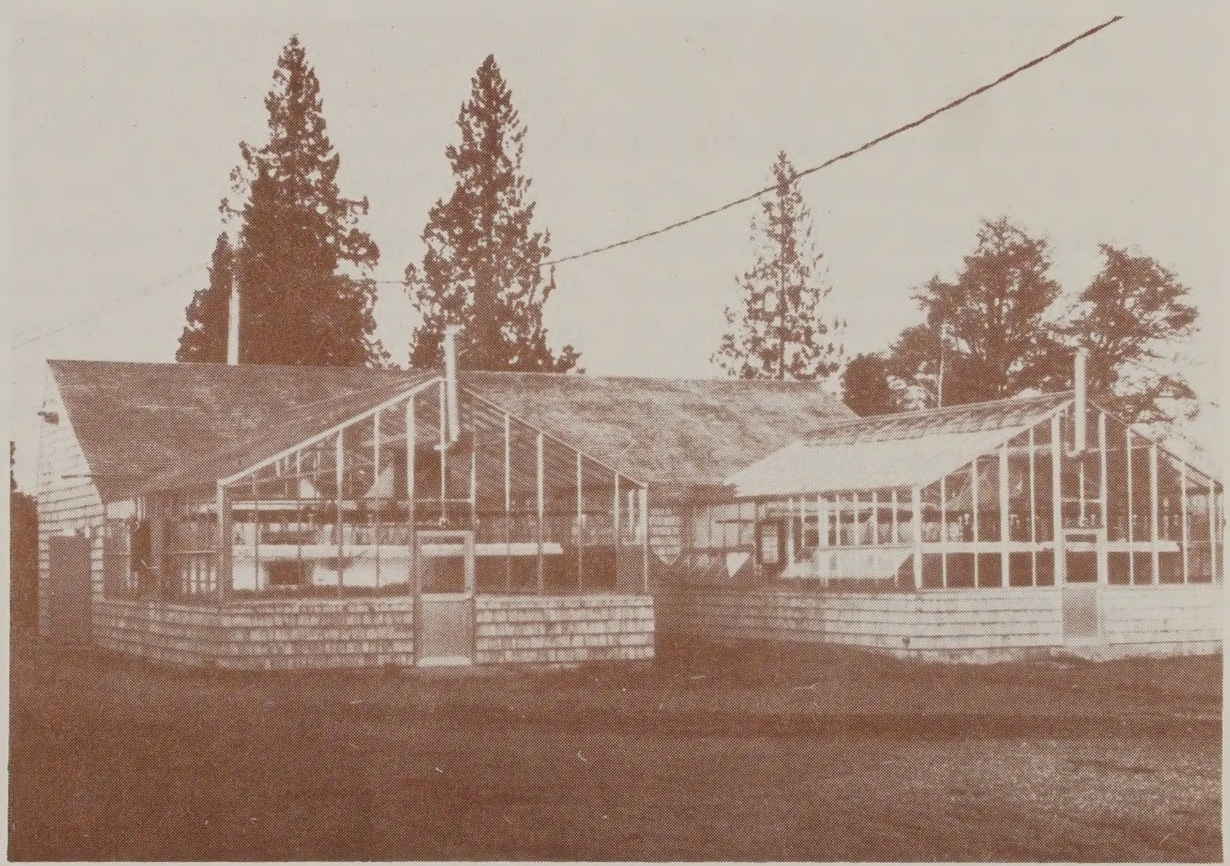
The Ornamental Plants Research Laboratory at Corvallis is a complex of facilities situated on the Oregon State University Campus. The main building, a two-story structure with attached greenhouses, includes offices and laboratories, growth chamber rooms, the Kenneth F. Baker Library, and special climate-controlled greenhouses. Each section of the greenhouses is heated and cooled separately. The greenhouses are equipped with high pressure sodium vapor lamps. These energy-efficient



Special high intensity discharge lamps in greenhouses at the Ornamental Plants Laboratory compensate for seasonal periods of low light intensity which limits plant growth.

lamps provide the needed light intensity for plant photosynthesis during the short winter days, thus allowing vigorous plant growth year-around. The lighted greenhouses are fast becoming a local landmark since they are highly visible to passersby and aircraft flying overhead. The adjacent enclosed field contains a storage building, a fiberglass greenhouse, a lath house, and small ground-bed plots. More extensive field space for ARS use is provided on the University's experimental farms.

At Puyallup, Washington, ARS research personnel have office and laboratory space in Washington State University buildings at the Western Washington Research and Extension Center. ARS also has one of its own greenhouse-growth chamber facilities on the station for ornamental plants research.



ARS greenhouse and growth chamber complex at the Western Washington Research and Extension Center, Puyallup, WA, where scientists are studying the physiology of flower induction in flowering bulb crops.

CURRENT RESEARCH PROGRAMS

ARS scientists in the Ornamental Plants Research units at Corvallis and Puyallup conduct research on various aspects of pathology and physiology which influence production and quality of nursery and florist crops.

Some of their objectives are:

- developing methods to reduce losses due to soilborne and foliar pathogens;
- developing a better under-

standing of how environmental stresses reduce growth, interact with herbicides, and predispose plants to diseases;

- improving cultural practices to increase quality and quantity of ornamental plants;
- developing biochemical and anatomical indicators of physiological readiness for forcing or harvesting of bulbs and woody trees and shrubs;
- exploring the potential use of beneficial fungi to reduce stress, and enhance the growth and adaptability of ornamental plants; and
- developing new and improved genetic types of ornamental plants with better quality, improved resistance to pests, tolerance to environmental stresses, and adaptation to harvesting practices.

PATHOLOGY RESEARCH

Florist, bulb, and nursery crops are susceptible to a wide range of diseases caused by pathogenic microorganisms resulting in reduced size, lowered quality, and even death of plants. The ARS researchers at Corvallis are studying some of the major diseases that occur in the Pacific Northwest and in many other parts of the world. Their primary research thrust is toward developing new technology to improve cultural practices and chemical and biological methods to prevent diseases. Their success means higher quality plants which ultimately benefits both grower and consumer.

Some examples of the diseases under study are: Rose Powdery Mildew; Holly Blight; a virus-like disease of rhododendron, *Phytophthora* diseases of many nursery tree and shrub species (rhododendrons, heather, juniper, rock daphne), lily root and bulb rot, stem lesion, and verticillium wilt of maple. Progress made on these studies includes control of Holly Blight with copper dips; demonstration of volatile action of new fungicides for control of Rose Powdery Mildew; discovery of the first virus-like disease ever reported on rhododendrons; improved methods for isolation and detection of *Phytophthora* in roots and soil; and elucidation of the cause of root base rot and stem lesion of lilies.

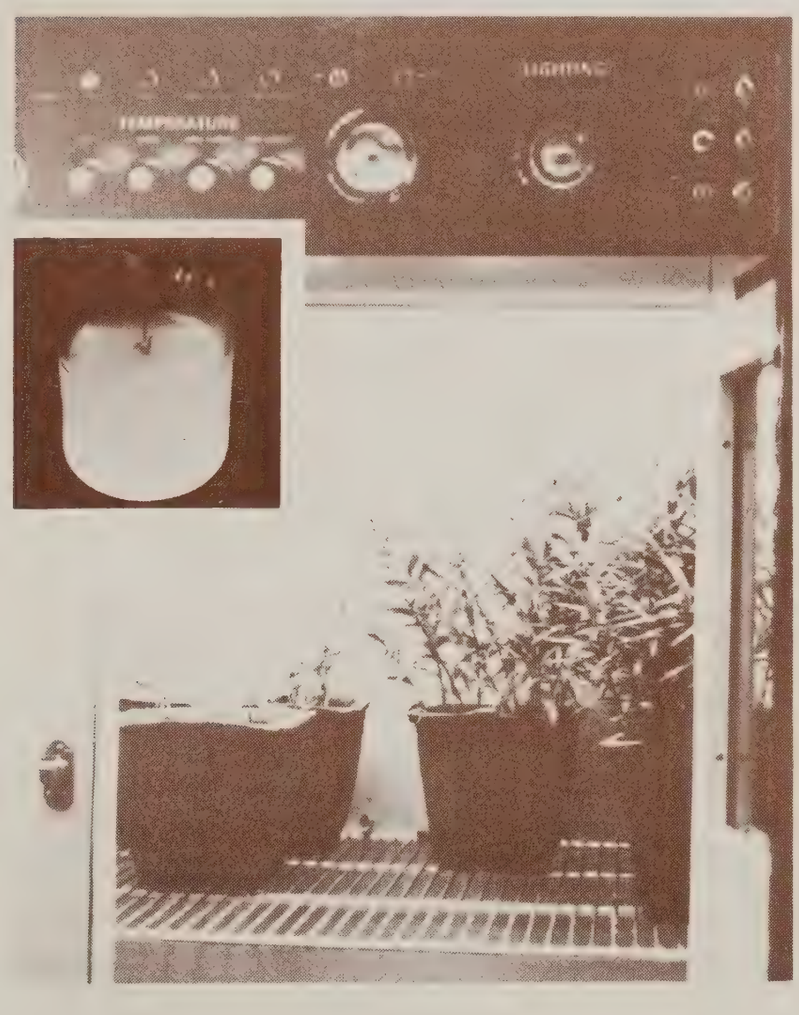
Another high priority research program is the investigation of the potential use of beneficial root-infecting fungi to enhance the growth and adaptability of ornamental plants, and to increase plant tolerance to environmental stresses and diseases. It is known generally that these fungi normally infect most plants, and that the fungi establish a symbiotic relationship called mycorrhizae that benefits plants in many ways. For example, ARS research has shown that when mycorrhizal fungus inoculum is added to the rooting medium, the rooting of vegetative cuttings of some woody plants is greatly increased.

Our researchers are studying methods for inoculating plants with these and other fungal allies, and are developing means to evaluate the benefits of the fungi to the host plants.

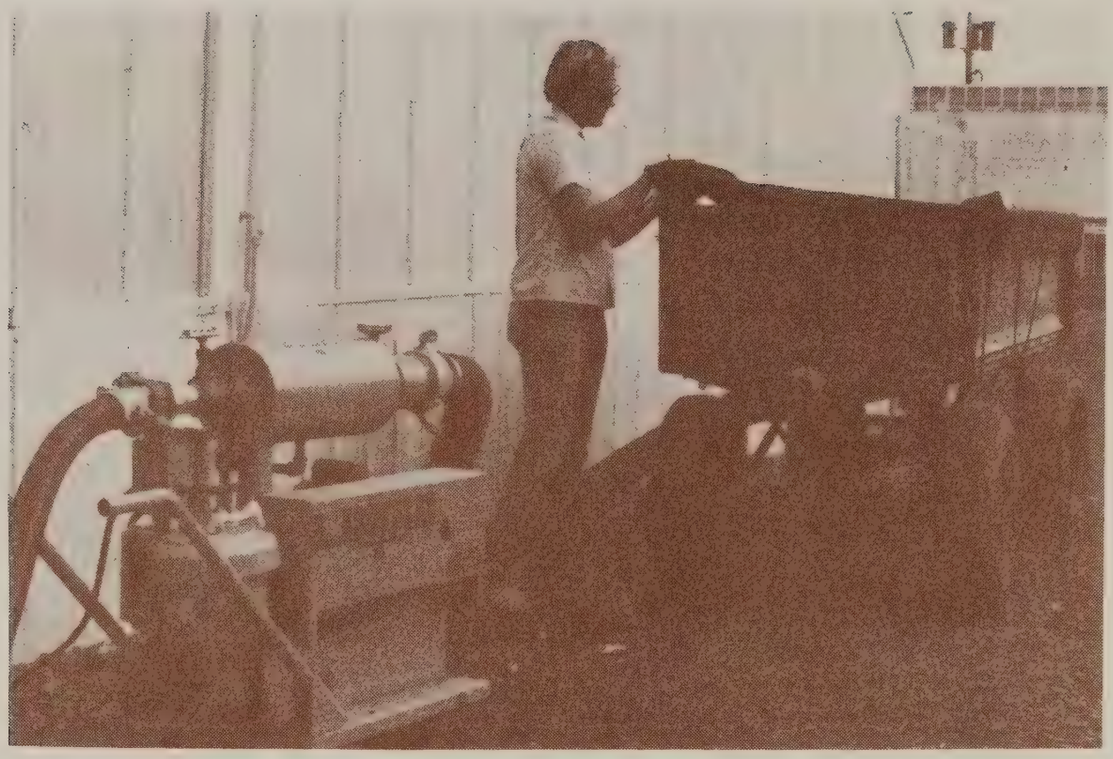
The troublesome powdery mildew of roses is caused by a fungus that can only grow on a living host plant. For experiments, pure cultures of the fungus are grown from single spores, produced in chains (see inset), and placed on leaves of plants grown in special isolation chambers inflated with filtered air.

Research is conducted to control Phytophthora on Christmas holly, an important Oregon product. The holly leaves and berries can be blighted by the fungus resulting in complete defoliation during shipment to markets across the nation.

Microorganisms which influence the growth of ornamental plants are aseptically transferred in this special hood that filters out all contaminating spores from the air.



Garden lilies grown under controlled conditions show effects of virus infection. The vigorous virus-free plants on the right are from small pieces of bulb scale grown in tissue culture (see inset). The technique eliminates all known pathogens.



Special equipment is used to kill soilborne pathogens. Soil is treated with steam cooled with air to 140°F which is the minimum temperature that kills pathogens yet spares some beneficial microbes.

Spores of mycorrhizal fungi large enough to be sieved from soil are collected under a microscope. Only a few spores are needed to begin a symbiotic relationship that enhances plant growth.

Roots are examined for mycorrhizae, a symbiotic association of host roots and beneficial fungi which were added to the rooting medium. Fungus infected roots often become swollen and branched (inset photo is enlarged from pin head size) and fungal strands extend into the soil to absorb water and nutrients for the host plant.

PHYSIOLOGY RESEARCH

The effect of environmental factors on plant growth and production of nursery, florist, and bulb crops is another major area of research by the Corvallis and Puyallup scientists. Special attention is being paid to the factors that most influence the production and distribution of photosynthetic products throughout all parts of plants. We're investigating factors such as temperatures, light, nutrients, pathogens, drought, cold, air pollution, oxygen deficiency, and herbicides for their effects on plants. After standard growth rates in test plants are established, then the effects of the various environmental extremes or stresses can be determined. Results

Centrifuged tissue samples are analyzed for starch to determine its relationship to the plant's ability to tolerate environmental stresses such as cold, drought, or nutrient deficiency.

of the studies will give growers better guidelines for improved cultural practices which lead to increased productivity.

The Corvallis researchers are looking for some reliable quantitative indicator to tell when plants are either approaching or actually in a stressed condition. This would allow growers to take remedial or preventive action before damage or losses could occur.

At Puyallup, the research is specifically focused on the development of anatomical and biochemical markers to show when field-grown iris bulbs are mature enough for storing and for forcing into flowering. The researchers are studying the environmental variables in the field which may be involved in preventing bulbs from maturing properly resulting in reduced cut flower yields.

The research programs in the Ornamental Plants Research Unit are dovetailed with those of the Environmental Protection Agency, the Forest Service, and the ornamental plant industries of the Pacific Northwest. Each of these agencies share the common goal of producing superior ornamental plants for our Nation and the world.

AGRICULTURAL RESEARCH SERVICE

The Agricultural Research Service (ARS), largest agency of its kind in the world, is the principal research arm of the United States Department of Agriculture. Its primary mission is to help meet the food and fiber needs of our Nation.

ARS works in close cooperation with State experiment stations and State departments of agriculture, other government agencies, public organizations, growers and industry.

ARS's research is conducted at more than 150 laboratories, field stations, and worksites in 46 States, the District of Columbia, Puerto Rico, the Virgin Islands, and nine foreign countries.

The Agency is divided into four locally administered geographical Regions. Twelve western States, including Hawaii, comprise the Western Region (WR). Headquarters is in Berkeley, California. The WR is further divided into six units—five Areas, and the Western Regional Research Center. Each is under the leadership of an Area Director. This organizational structure is designed to insure an aggressive research program by ARS and to provide for its maximum responsiveness to the problems and needs of the people it serves.

ARS IN OREGON-WASHINGTON AREA

Pullman, Washington, is the headquarters for the Director of the Oregon-Washington Area who administers the research programs at Corvallis, Oregon, at Puyallup, Washington, and at six other locations in these two States. The studies carried on at the Corvallis and Puyallup research facilities are vital in helping ARS achieve its goals. At the same time, this research is particularly important to the Northwest ornamental plant industries and to wholesale and retail growers and to consumers in the rest of the Nation.

VISITORS

Visitors to the Ornamental Plants Research Laboratory, Corvallis, Oregon, and to the Puyallup, Washington work site are welcome. If possible, arrangements should be made in advance by phone or letter to:

Research Leader, ARS-USDA
Ornamental Plants Research Laboratory
3420 S.W. Orchard Street
Oregon State University
Corvallis, Oregon 97330
Telephone: (503) 757-4544

For information about specific research at the Corvallis or Puyallup locations, contact the above. For information regarding agricultural research being conducted elsewhere in the Oregon-Washington Area, or ARS-wide, contact:

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Oregon/Washington Area,
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Pullman, Washington 99163
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